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INSECT RECORD FOR 1899

BY CLARENCE M. WEED

NEW HAMPSHIRE COLLEGE

AGRICULTURAL EXPERIMENT STATION

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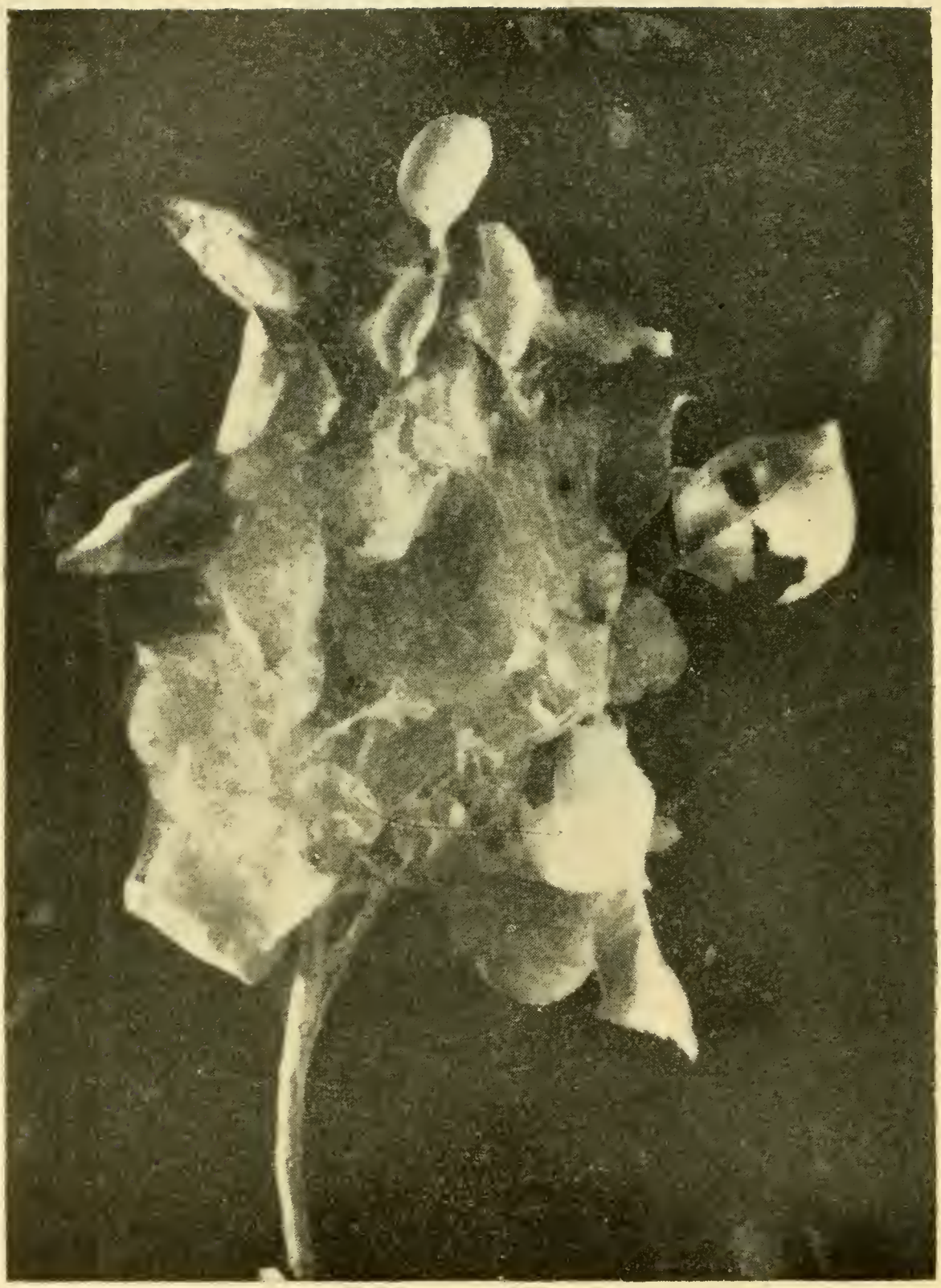

Fig. 12. Apple twig, showing web of a young colony of Web-worms.

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The most notable item in the appearance of insects in New Hampshire in 1899 was the continuation of the outbreak of the Forest Tent Caterpillar (*Clisiocampa disstria*) or Maple Worm, which in many parts of the state was very severe and resulted in much injury to forest and shade trees. A bulletin describing this insect was issued by the station last May, and a second report upon it is now in preparation for publication at an early date.

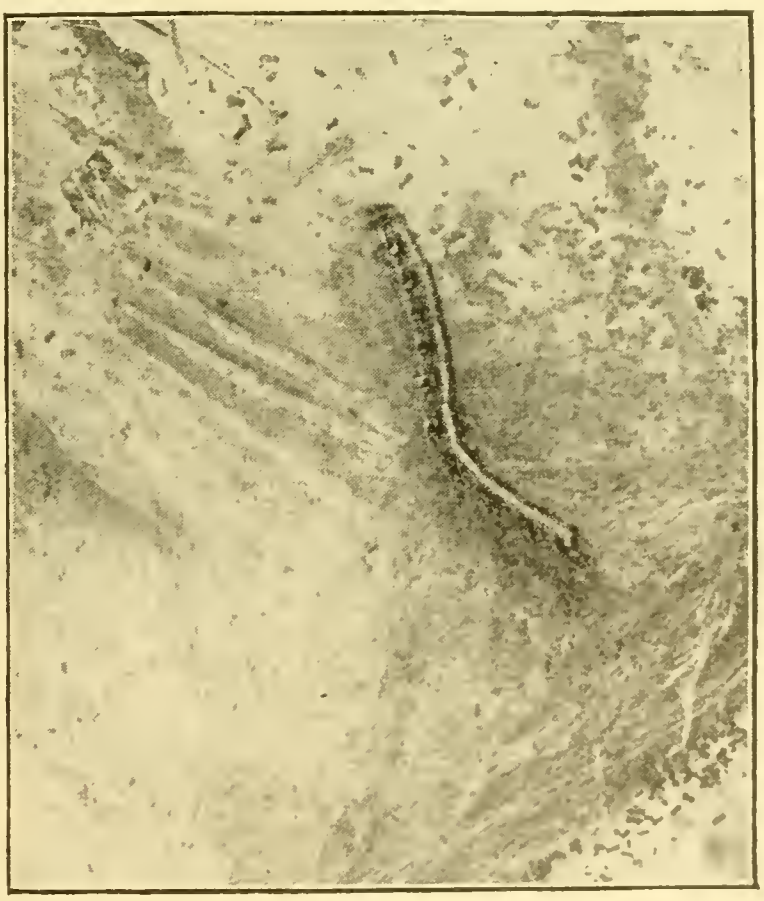


Fig. 13. The American Tent Caterpillar.

The Spiny Elm Caterpillar, the larva of the Mourning Cloak or Antiopa Butterfly (*Vanessa antiopa*), was also extraordinarily abundant, and has been fully discussed in the October bulletin of this station.

In the annual report of this station for 1898,* I called attention to the great destruction of American Tent Caterpillars (*Clisiocampa americana*) which had taken place in April and June, and predicted that this pest would be less numerous in 1899. This prediction has been abundantly verified, for the scarcity of these caterpillars has been one of the most remarkable entomological events of the year. Many correspondents in different parts of the state have called attention to the absence of the usual nests, and have asked the reason for it. In my own field trips I have gone over most of the state and have found almost everywhere a similar scarcity, while Mr. Fiske, who has traversed some sections where I have not been, makes the same report. The only place where we have found the caterpillars at all common is a small region in the extreme southeastern part of the state.

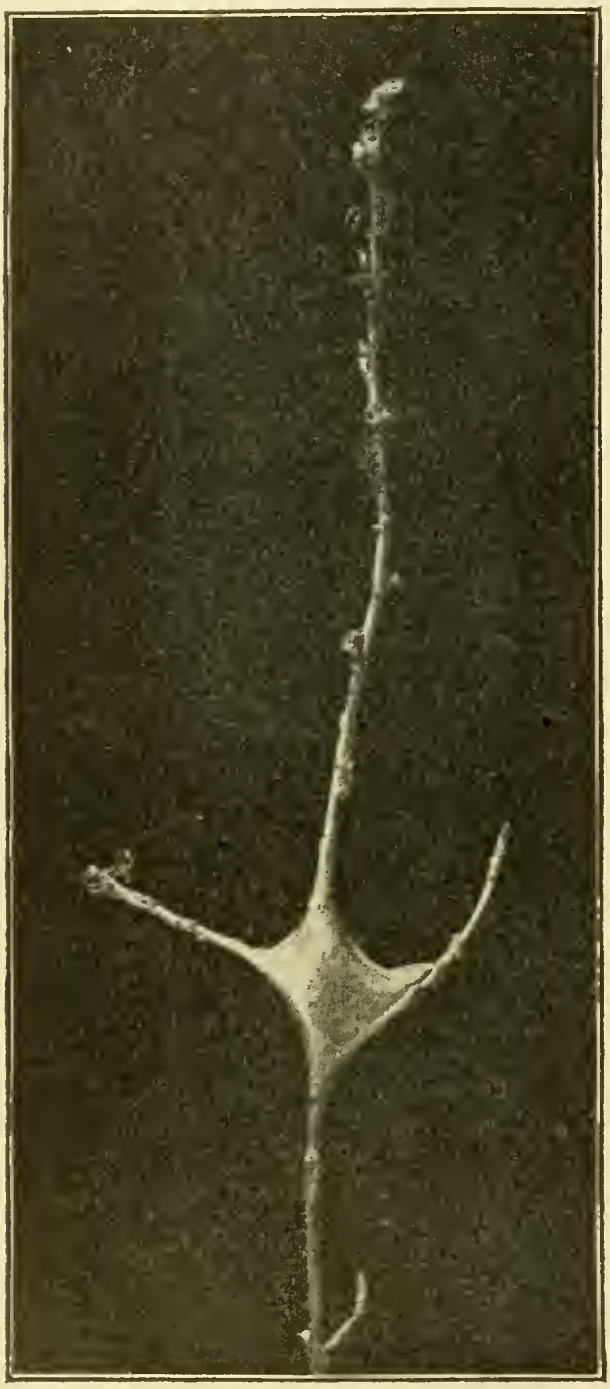


Fig. 14. Nest of young Tent Caterpillars over egg-mass.

There seems to be little doubt that this lessening in the numbers of these caterpillars is due to the causes described in my last report. In 1898, when the caterpillars were hatching and before they had time to make the protecting tent (Fig. 14) that they commonly construct very

* Bulletin 59, November, 1898, page 201.

soon after coming out of the egg there were heavy and long continued rains. As a result a large proportion of the young caterpillars were washed away and killed. In general, those only survived that were able to shelter themselves on the under surface of the twig to which the egg mass was attached. "Consequently," as I wrote in last year's report, "at the beginning of the season of 1898 there was a considerable reduction in the numbers of the caterpillars. The survivors, however,

Fig. 15. American Tent Caterpillars killed by disease.

developed in sufficient abundance to be decidedly in evidence in May, but during the last weeks of their growth there appeared among them a bacterial disease, a sort of insect cholera, which killed them in vast numbers. The effectiveness of this disease was doubtless increased by the wet weather prevailing at the time. Early in June nearly every nest was full of the dead and dying caterpillars, those upon the outside of the web hanging limp and lifeless at first (Fig. 15), and then gradually shriveling up until only the dried skins told of their presence

A series of observations made upon a large number of nests just before the period of pupation showed that more than ninety per cent of the caterpillars present had been killed by this disease. As a result there were few caterpillars crawling along the roads in early June, although during previous seasons great numbers were to be seen at that time." It is possible that in other localities the destruction may have been largely brought about by parasites.

This sudden decrease in numbers is an illustration of what commonly takes place with most of our noxious insects when they have been extraordinarily abundant for several seasons. The causes that bring about the decrease are not always the same, and definite knowledge of them is seldom obtained. It is probable that a predisposing cause is the lessening of vitality because of the limited food supply, and many sorts of parasites are nearly always at work to keep the pests in check. After such a sudden check only a few of the insects remain; these continue to feed and to breed, gradually increasing from season to season, until after a series of years the insect again becomes destructively abundant.

The point which needs especial emphasis, however, is that *the best time to fight an insect is when it is thus at its lowest ebb.* Thus when these caterpillars are as scarce as they were in 1899 every colony destroyed reduces by so much the recuperative powers of the species; it is the time for the stitch that shall save many more than nine. Each caterpillar that matures into a female moth will lay two hundred or more eggs for the next season's crop, and about half of the progeny of these eggs will in turn develop into other female moths that will lay two hundred or more eggs, and so the increase will continue in geometrical progression until in eight or ten years the pests will again become destructively abundant, and people will begin to destroy them. But they should instead destroy them during these years of scarcity, when every colony destroyed means as much as the destruction of a hundred colonies ten years hence.

During the abundance of these Tent Caterpillars certain birds—especially the Baltimore oriole and the cuckoos—had

been in the habit of feeding freely upon them, often depopulating a nest. Last spring these birds continued their good work, and did good service by exterminating a large proportion of the colonies that were present. In Fig. 16 is shown a nest in which holes had been made by one of these birds for the purpose of extracting the caterpillars. The orioles are likely to pierce the skin of the caterpillar and to extract some of the body contents, while the cuckoos swallow the insect whole. This difference in manner of feeding may help to determine whether a given caterpillar's nest has been raided by oriole or cuckoo. If there are many dead and mutilated larvæ on the branches near the tent it was probably an oriole; if the caterpillars are gone and there are no such remains it was probably a cuckoo.

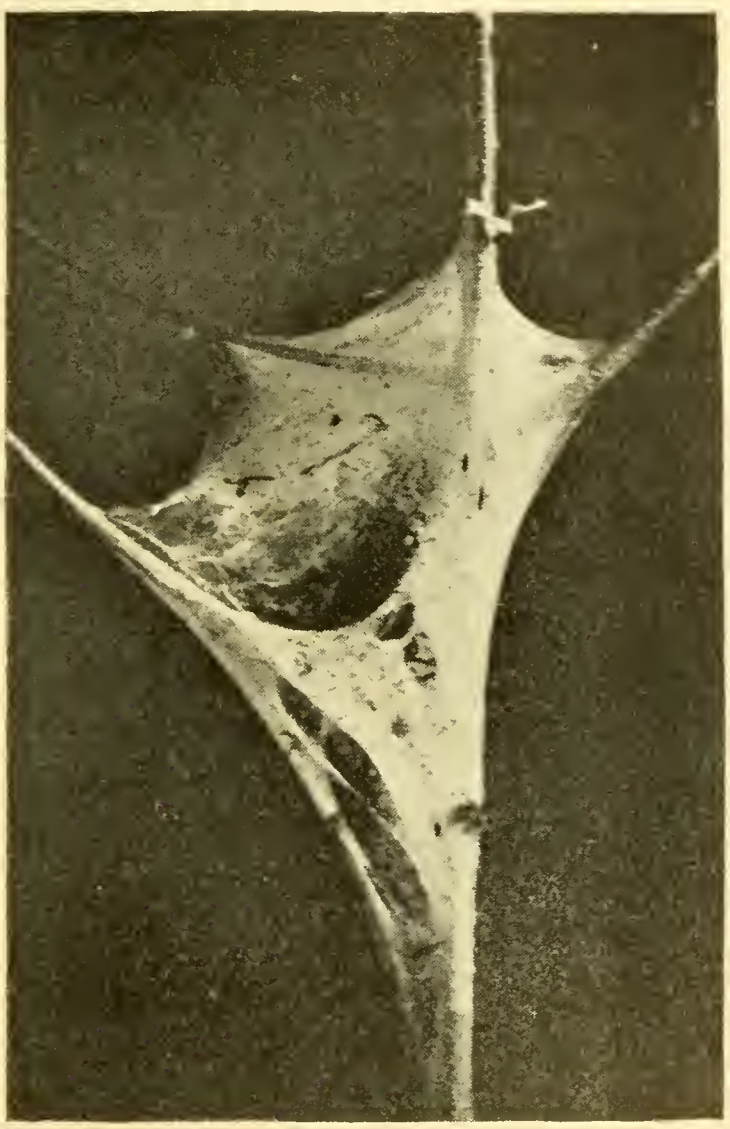


Fig. 16. Caterpillars' nest attacked by birds.

The work of few insects in early summer is more noticeable than that of the CHERRY TENT-MAKER or CHERRY TWIG-TYER (*Cacoecia cerasivorana*), which has been extraordinarily abundant during the last two years. This is the insect that so webs the young bushes of the wild choke cherry by the roadside that they look like a series of miniature white tents.

Rather early in spring, soon after the leaf-growth is well started, the colonies of tiny caterpillars hatch from eggs—laid apparently the season before—and congregate upon one or two leaves. They roll these up by means of silken threads and eat the green surface on the inside of the roll. As they grow they draw together neighboring leaves, feeding on their substance, and continually spinning the silken threads that form the tent. The condition of the tent when the caterpillars are about half grown is illustrated in Fig. 17. Later more leaves and branches are drawn together until the tent form is reached.

Fig. 17. Cherry Tent in process of formation; caterpillars about half-grown.

By this time the caterpillars are generally full-grown so far as this larval state is concerned. They now retire to the middle of the tent, where they unite to form a colony of cocoons side by side, more or less intermingled with the dried particles of excrement. Within these cocoons the larvæ change to pupæ, the quiet stage in which they rest and take no food. In about two weeks the pupæ wriggle out from the cocoons and reach the outer surface of the tent. Then they split apart and the small orange-brown moths come out. The empty pupa skins as they hang on the deserted tents are shown in Fig. 18.

These moths live for about two weeks. They deposit their eggs in flat masses, presumably upon the bark of the cherry bushes, although this has not been definitely ascertained. We have seen no indication of a second brood, which would indicate that the eggs remain unhatched until the following spring.

Fig. 18. Moths of the Cherry Tent-maker on tent.

There are many parasites that prey upon these larvæ, and it is probable that these enemies will soon so reduce their numbers that they will not be noticed. Of course the Tent-makers do little real damage because their food-plant has so little economic importance. The cutting and burning of the tents any time before the moths emerge will destroy the insects.

Early in June Mr. W. H. Roberts of Manchester sent some small apples which had been bitten by an unknown insect. Some of the marks upon the fruit were the characteristic crescent cuts of the Plum Curculio (*Conotrachelus nenuphar*), so that I at once concluded this insect to be the cause of the damage.

From a hundred apples received later from the same orchard, many adult Curculios were reared in August, as well as a few Codling Moths which emerged in July. Mr. Roberts estimated that ninety-nine per cent of the apples in an orchard of a hundred trees had been stung by the insect.

The Plum Curculio has long been known as one of the most troublesome pests infesting fruits. Although it more commonly affects plums, cherries, and peaches, it has repeatedly been found to injure apples. The adult or fully developed insect is a small hard-shelled beetle about a quarter of an inch long; it is of a mottled brown color, and has a well-developed snout as well as four humps or tubercles on its back. This adult beetle passes the winter under shelter on the ground. In spring it appears in the orchard about the time the leaves begin to come out, and nibbles at their green surfaces as well as at the flowers when they appear. A little later, when the blossoms fall and the fruit "sets," these beetles eat small holes out of the surface. All of this nibbling is to satisfy the hunger of the adult beetles, but when the fruit is fairly set the female beetles cut crescent-shaped marks in the skin and deposit their eggs in the pulp. These eggs hatch in a week or so into little grubs that feed upon the green inner part of the fruit, gradually working towards the pit. They become full-grown in this grub state in a few weeks, and by that time the infested fruit is likely to have fallen to the ground. Then the grubs or larvæ leave the fruit and go into the soil a short distance. Here they change the third stage of life—the pupa stage—and a few weeks later again change and come forth as fully developed beetles. There is generally but one brood a year.

In plum orchards the accepted means of preventing the injuries of the Curculio has long been that of jarring the insects onto some sort of cloth-covered frame in which they are caught. More recently it has been learned that a considerable proportion of the adult weevils can be killed by spraying with Paris green or other form of arsenites. This method is successful in orchards of good size rather than in the case of a few trees. In such an instance as that of the apple orchard mentioned above, spraying seems to be the most advisable rem-

edy. The best spraying solution perhaps is the Bordeaux mixture with the addition of an ounce of Paris green to each ten gallons of diluted mixture. This is effective against both insect and fungous enemies, acting specifically upon the Curculio, Codling Moth, and Apple Scab.

Fig. 19. Apple leaf denuded by young Web-worms.

Where there is danger of injury by Curculios the first application may well be made just before the blossoms expand—never when the blossoms are open—and the second when the fruit is well formed, but before the scales at the blossom end of the young fruit have closed up. In case an examination ten days after the second spraying shows many freshly cut crescent marks, a third spraying may be advisable. Instead of the Paris green and Bordeaux mixture, Paris green alone may be used, but a little fresh lime-water should be added to prevent injury to the foliage; or arsenate of lead may be used instead of Paris green. With this arsenate of lead there is no danger of injury to the foliage; it is now on the market, being manufactured by Wm. H. Swift & Co., 66 Pearl street, Boston, Mass., from whom it may be purchased if local dealers are unable to supply it.

The injuries of the FALL WEB-WORM, mentioned in last year's report, have continued the present season. During August the unsightly webs were to be seen in apple orchards as well as along roadsides and in fields generally. Many orchards are injured to a greater extent than is realized by their owners, who might so easily destroy the pests.

These web-worms hatch from eggs laid in clusters upon the leaves by a whitish moth. As soon as hatched the tiny caterpillars begin to spin a protective web; they are then yellowish, marked with black, and have a few hairs projecting from their bodies. They spin webs over the nearest leaves and then feed upon the green substance of the leaf, eating this out so that the net-work of veins remains, as may be seen in Fig. 19. As the days go by they enlarge the web to cover other leaves, which are in turn attacked. About once a week they moult, or shed their skins, remaining always beneath the

Fig. 20. Apple leaves eaten by older Web-worms.

protecting web. When they become nearly full-grown as caterpillars they eat more or less of the veins along with the leaf substance, generally avoiding the midribs (Fig. 20).

The full-grown web-worms are a little over an inch long, with the body densely clothed with yellowish hairs. They now leave the trees and descend to the ground, where they spin slight silken cocoons, within which they change to the

chrysalis state. Here they remain until the following June, when they emerge as moths to lay eggs for another brood of web-worms.

These web-worms appear so late in the season that it is impracticable to spray orchard trees for them. But a little careful observation in July and early August will lead to the discovery of the young colonies, when it is an easy matter to cut them off and burn or crush the larvæ. It is especially important that this should be done on young trees, for otherwise serious injury may occur.

The extraordinary drouth during the summer served to make more serious the outbreaks of WHITE GRUBS which occurred in various parts of the state. There was a very general injury to pastures and lawns, and some crops other than grass were injured. From Brentwood serious damage to strawberries was reported. These pests are the young or larvæ of the common May Beetles or June Bugs; they hatch from eggs laid during early summer about the roots of grasses. The young grubs feed upon these roots, growing very slowly, so that two or three seasons are required for their development. When they finally become full-grown in this grub or larval stage each forms an oval cell in the soil in which it changes to the pupa state. A little later it changes to an adult beetle. These changes generally take place in autumn, and the beetles remain in the earthen cells until the following spring. Then in May they come forth to feed upon the leaves of various trees.

These white grubs have various natural enemies. Robins, blackbirds, crows, and other birds devour them, and they are preyed upon by certain insects, but their most important foe seems to be the skunk. It is well known that a large proportion of the food of this animal in summer consists of these grubs. I saw striking evidence of this in a hillside pasture in Durham last summer. This pasture was seared and brown, the grass having been killed by the combined efforts of the grubs and dry weather. All over its surface toward the end of the summer were to be seen the little holes where the skunks had dug down and captured the grubs. I estimated that in many parts of the field there was one of these holes to every

square foot of surface. Evidently the skunks were doing a very useful service in helping to reduce the numbers of this pest.

These insects are difficult to contend against by artificial means. Breeding in grasslands, meadows and pastures are often temporarily ruined by them, while crops planted on sod lands are frequently destroyed. It will often pay when land infested by these grubs is to be planted to strawberries or other crops which they are liable to injure, to have a boy follow the plow and collect the grubs as they appear in the furrow. In this way a large amount of damage may frequently be prevented at small cost. The grubs in infested meadows and pastures may be destroyed by turning swine into the field.

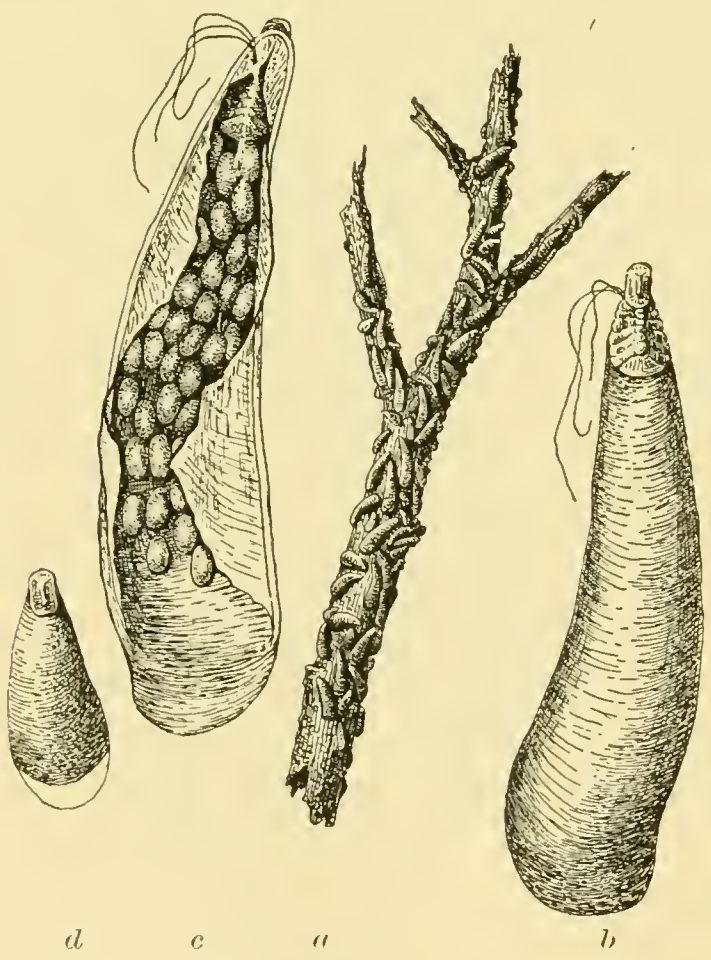


Fig. 22. Oyster-shell bark-louse: *a*, scales on apple twig; *b*, female scale, back view, magnified; *c*, female scale and eggs, under-side, magnified; *d*, male scale, magnified.

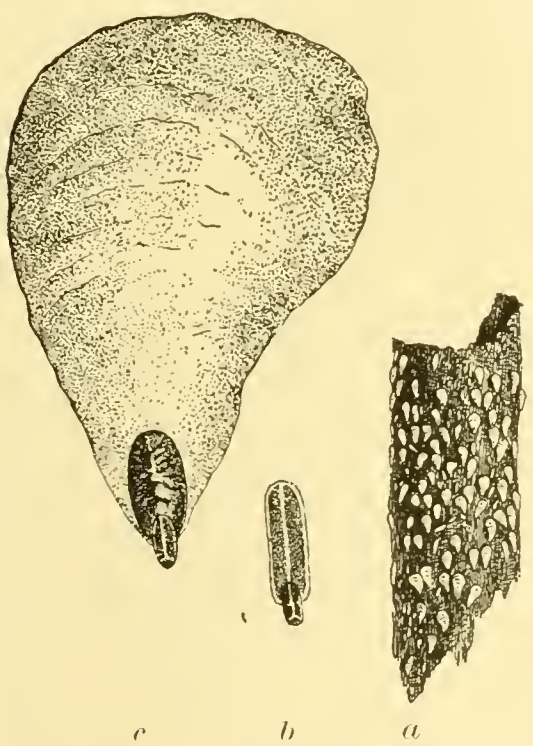
Evidence continues to accumulate that the OYSTER-SHELL BARK-LOUSE (*Mytilaspis pomorum*) is doing much damage to the orchard industries of New Hampshire, an injury which is none the less to be feared because it is so often overlooked. These insidious insects are present in a very large proportion of our apple orchards, although they do most damage to young and more or less neglected trees.

By looking carefully at the bark of the twigs, branches, or trunk of a tree where this insect is present one will see small grayish scales resembling in form miniature oyster-shells; their general ap-

pearance as thus seen upon the bark is represented in Fig. 22, *a*. They are of two sizes, the larger form being generally the more abundant. If you look through a magnifying lens at one of these larger scales you will see it looks like *b* of the same figure; this is the female scale and on its under surface are a great many small oval eggs (*c*). The smaller scales are those of the males; when magnified they look like *d*.

During the latter part of May the eggs beneath the larger scales hatch into tiny whitish insects that wander over the bark and finally settle down and insert their beaks to suck out the sap. When they have thus become settled they remain in position, gradually increasing in size as the weeks go by. By the end of the season the scaly coverings have been secreted.

At the time these insects are wandering over the bark they may easily be killed by spraying with kerosene emulsion.



c *b* *a*

Fig. 23. The Scurfy Scale: *a*, bark showing scales in position, natural size; *b*, male scale, magnified; *c*, female scale, magnified.

A closely related insect, the SCURFY BARK-LOUSE (*Chionaspis furfura*), has been sent in once or twice on the supposition that it was the San José scale. This Scurfy Scale is illustrated in Fig. 23. A piece of bark showing the scales, natural size, is shown at *a*; the male scale somewhat magnified at *b*, and the female scale at *c*. The life-history of this species is quite similar to that of the Oyster-shell Scale, and the remedial treatment is the same.

Considerable complaint was made during the summer of the ravages of APHIDES or PLANT-LICE. These insects are always more destructive in dry seasons than in wet ones: the dry weather favors their development and it also prevents the plants from quickly recovering from the injuries inflicted by the insects. Early in the season much injury to apple trees

by the APPLE APHIS was reported, the insects developing on the under sides of the young leaves and causing them to curl up. Later especial damage to garden peas and sweet peas* was reported from widely separated parts of the state.

Kerosene emulsion or tobacco decoctions are perhaps the best remedies for plant lice. We have used a special tobacco extract called Rose Leaf Insecticide, made by the Louisville Tobacco Company, with excellent results against these pests. This is a concentrated liquid which is to be diluted before using, and it has proven one of the most satisfactory insecticides upon the market.

The unusual drouth of the last two summers has also favored the increase of the common GRASSHOPPERS or LOCUSTS. During the summer of 1899 these insects were so abundant in the central and southern parts of the state as to do serious injury to pasture and meadow land, their attacks helping to lessen the crop already shortened by the dry weather, and in some cases by the white grubs gnawing at the grass roots. The species at work was for the most part the common Red-legged Locust (*Melanoplus femur-rubrum*) although certain other kinds were unusually abundant.

The life-history of these different grasshoppers is essentially the same. During the latter part of summer the adult females deposit their eggs in the ground, slightly below the surface, in several masses of twenty-five or more each. These eggs remain in position until early the following summer, when they hatch into little grasshoppers without wings, but otherwise having the general appearance of the adults. These little creatures feed upon the tender blades of the growing grass, moulting or casting their skins occasionally to provide for their increase in size. They mature in about six weeks, adults of the Red-legged species being common by the last of June.

There is a state bounty of one dollar a bushel, authorized by a law passed in 1883, for collecting Rocky Mountain Locusts, and the provisions of this act have commonly been made to apply to the species found in this state.

* Probably due to the species of plant-louse recently described as *Nectarophora destructor* by Prof. W. G. Johnston.